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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/387,477	09/01/99	TOMITA M	TIJ-26105

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EXAMINER	
MEIER,S	
ART UNIT	**PAPER NUMBER**
2822	

DATE MAILED: 02/15/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	09/387,477	TOMITA ET AL.	
	Examiner	Art Unit	
	Stephen D. Meier	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 January 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9* is/are pending in the application.

4a) Of the above claim(s) *1-7* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8 and 9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
18) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

Applicant's election without traverse of Group II, Claims 8-9 is acknowledged. Claims 1-7 stand non-elected.

Claims 8-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The grammatical syntax of the claims renders the metes and bounds indefinite. Note the rejection over art below, for a clearer format for claiming Applicant's invention. The specification shows a connection hole is formed over the lower conducting layer, however claim 8 appears to state there is a connection hole in the insulating layer at a point other than over the lower conducting layer. The phrase "the lower electrode layer" or alternatively "the lower electrode layer formed in the connection hole" lacks antecedent. The phrase "formed to the center position of the thickness of the titanium nitride layer" is nonsensical, since a thickness has not been defined. Likewise in claim 9, the grammar renders the claim indefinite. Use of "comprising" renders the sentence absent a proper verb or verb transitive, and likewise makes "a stacked structure" lack proper antecedent.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 8 insofar as definite is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (6,080,664) in view of Miyazaki (5,804,878).

Huang teaches a structure in Figure 10 which provides a contact structure for a source/drain region of a FET. Specifically Huang provides a lower conducting layer 4, an insulating layer 5 on the lower conducting layer, and a connection in the insulating layer and centered over the lower conducting layer. An upper conducting layer 6 is formed in the connection hole. Huang fails to teach that the lower conducting layer has a TiN layer on its surface. Miyazaki also teaches an interconnection structure for a FET in Figure 1D. Miyazaki however has a lower connection layer of a trilayer structure comprising a central Al layer 15 protected by TiN barrier layers 14 and 16 on top and bottom. The TiN layer "has excellent barrier characteristics and prevents diffusion of aluminum and silicon" (Column 3 lines 14-15). Miyazaki teaches an upper connection layer 13 (Figure 1C), but does not explicitly show an insulating layer with connection hole. It would have been obvious to a skilled artisan to combine the structure of Huang having a connection hole structure with that of Miyazaki having a layer connection plug in order to protect the device from Al and Si diffusion as taught by Miyazaki.

Claim 9 insofar as definite is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Miyazaki as applied to claim 8 above, and further in view of Danek (5,942,799) and Watanabe (6,177,343).

Danek teaches in the abstract a multi-layer diffusion barrier with a "first sublayer formed of a refractory metal, or a refractory metal nitride; and a second sublayer formed

of a refractory metal nitride, a refractory metal silicon boride, or a refractory metal oxonitride." Refractory materials such as Ti and TiN are suggested in Column 4 lines 30-42. Danek provides a functional equivalent diffusion barrier of Ti and TiN and compared to the single diffusion barrier of TiN taught in Miyazaki. It would have been obvious to a skilled artisan to combine the teachings of Danek with Huang and Miyazaki by replacing the single layer TiN of Miyazaki with a multilayer Ti and TiN as a functionally equivalent means of preventing diffusion of Al and Si.

Watanabe, like Huang and Miyazaki, teaches an interconnection structure for a FET. Watanabe particularly provides in Figure 39c a multilayer insulating structure 14 comprising TEOS oxide 5, SOG layer 7 and TEOS oxide 8. The insulating structure 14 is provided with an interconnection hole so that lower conducting layer 15 may be connected. In column 5 lines 48-57 it is taught that the layers 5 and 8 "eliminate influence of water and the hydroxyl groups in the modified SOG film on the MOS transistor." Watanabe provides a functionally equivalent insulating means of a trilayer structure to replace the insulator 5 of Huang. It would have been obvious to a skilled artisan to replace the insulator of Huang with the functionally equivalent trilayer structure of Watanabe in order to have an improved interconnection structure that is flat and protects the device from inherent properties in the insulator as taught by Watanabe.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Meier whose telephone number is (703) 308-4896. The Examiner is off on the first Friday of each biweek, however can generally be reached Monday through Friday during normal business hours, including first Fridays of the biweek.

Any inquiry of a general nature or relating to the status of this application should be directed to the group receptionist whose telephone number is (703) 308-0956. The fax number for the group is (703) 308-7722.

Meier
February 8, 2001

Stephen D. Meier
Primary Examiner
Art Unit 2822